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The Sources and Intakes of Vitamin B12 in McPherson College Students

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ABSTRACT

The objective of this research was to determine the intake levels and major sources of vitamin B12 in McPherson College Students. Correlations were done to see the difference of intake levels of animal based sources versus other sources, between athletes and non-athletes, and between males and females. Thirteen subjects were given three food journals over a period of eight weeks. Once the journals were returned the data was analyzed using Nutrition Calc 3.0. There were more participants who were deficient in the weekly averages than in the overall average. No correlation was found in the t-tests between males versus females, athletes versus non-athletes, or between the animal sources versus other sources. However, upon removal of outliers the animal source was found to be significantly different from other sources [p-value= 0.0004]. Future experiments could be done to compare the dietary intake of vitamin B12 to blood serum levels.

Keywords: *Vitamin B12, Vitamin B, Nutrition and Diet, Recommended Daily Intake (RDI)*

INTRODUCTION

Diet and nutrition is a necessary part of all people lives, yet most do not know many of the nutrient requirements or sources of vitamins they should be getting. The vitamin B complex consists of eight vitamins each with a specific function in the complex. The vitamins within the complex are usually referred to as one because they are found together in foods and because they often share certain functional attributes within the body (O'Leary, et al 2006). Vitamin B12 (cobalamin) is one of the major B vitamins; its main functions are red blood cell production, aiding the function of metabolism, nervous system function, sperm production, and aiding the function of the immune system (Gay, et al 2001). The recommended daily intake (RDI) of B12 for 18-24 year olds is 2.41 micrograms per day for both males and females (USDA, 2011).

A B12 deficiency is not very common but is often seen in vegetarians/vegans. This is because most vitamin B12 comes from animal products such as the liver and giblets of turkeys or chickens. Beef hamburger, and seafood are also other large source of B12. Fortified cereals tend to be the only large source of B12 that is not of an animal source (USDA 2011). Although deficiency is rare, it often happens to elderly and vegetarians/vegans. It is known to cause subtle, non-specific symptoms in the early stages; while severe deficiency often leads to megaloblastic anemia (Loikas, et al 2007).

The effects of B12 have been thoroughly studied, but not much research has looked at the sources or intake of B12 specifically. In my research, I will survey the student body of McPherson College to better understand where they get this nutrient and how much they are getting on a daily basis. In most studies looking at the intake levels of a vitamin a blood serum sample is taken (Loikas, et al 2007). On the other hand dietary intake amounts can be estimated using a food journal to record the levels of intake.

In my results, I expect to find that most students are meeting their RDI requirements of vitamin B12. This is mainly because of the commonality of animal-based foods. However, I also expect to see either average of less than average intake in students who follow a vegan or vegetarian diet. This would be expected because most of the sources of are animal based which would not be a part of these diets.

MATERIALS AND METHODS

The materials used in this experiment were food journals for diet analysis, a portion guide to help accurately measure portions, Nutrition Calc 3.0, and Microsoft Excel for data analysis.

Thirteen random participants who are McPherson College Students were used in this experiment. Once the participants agreed it was explained that they would be filling out three food journals. These participants were given the journals and also a food portion guide (Figure 1). The guide was given to subjects to ensure that they were able to record amounts of food portions correctly. Participants completed a three day food journal, and then two more journals a week apart from each other. Each journal was filled out using three consecutive days.

The journals were then collected from each participant, and the vitamin B 12 amounts for each participant were recorded using the diet analysis software Nutrition Calc Plus 3.0 (2008).

Then, Microsoft Excel was used to complete the data analysis of vitamin intake amounts and find any statistical significance between variables. This was done by running either a one-tailed paired t-test, or a one-tailed t-test assuming unequal variance which returns a p-value for the data input. These were run between participants and recommended daily intake to test for significant difference, also between three different groups: males versus females, athletes versus non-athletes, and animal based sources versus other sources.

Hand Symbol	Equivalent	Foods	Calories
	Fist 1 cup	Rice, pasta Fruit Veggies	200 75 40
	Palm 3 ounces	Meat Fish Poultry	160 160 160
	Handful 1 ounce	Nuts Raisins	170 85
	2 Handfuls 1 ounce	Chips Popcorn Pretzels	150 120 100
	Thumb 1 ounce	Peanut butter Hard cheese	170 100
	Thumb tip 1 teaspoon	Cooking oil Mayonnaise, butter Sugar	40 35 15

Figure 1. Portion guide given to participants. (McVeigh 2011)

RESULTS

All diets were analyzed using Nutrition Calc Plus 3.0. After imputing the diets into the system the following reports were taken: Average journal intake, overall intake, and a comparison between, males vs. females, athletes vs. non-athletes, and animal products vs. other products.

Looking at weekly differences in averages showed that there were seven different diets that showed deficiency. This was determined by using a paired t-test where each data point is paired with the RDI and therefore shows whether it is or isn't significantly different from the RDI. A value of .05 or lower means that the data point is significant.

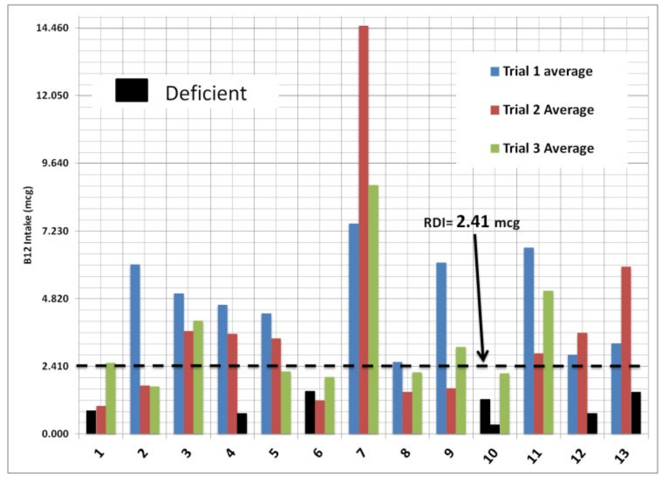

Figure 2. Weekly Averages for subjects are shown in the above graph. It is organized by subject with each bar represents one trial for each person. The dashed black line represents the RDI of 2.41 mcg. If a bar of a subject is black it means that the p-value was significant for that week journal.

As well as finding the weekly average an overall average was found by averaging the weekly averages. A one-tailed paired t-test was then run to determine which overall averages were significantly lower than the RDI. This returned that only one diet was deficient of B12.

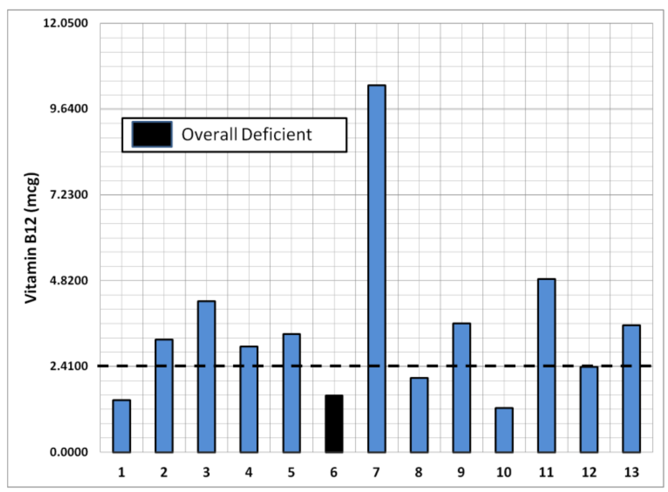

Figure 3. Overall averages of Vitamin B12. In the graph it shows the dashed line is the RDI level. The black bar tested deficient for B12 based on their overall averages and standard deviation.

A one tailed t-test assuming unequal variance was done to determine significant difference between male intake and female intake. This type of test was chosen because there is no maximum intake level of

B12, and because the sample group's variances were unequal. A value of 0.2967 was returned, and an alpha-value of .05 was used, meaning there was no significance between the two.

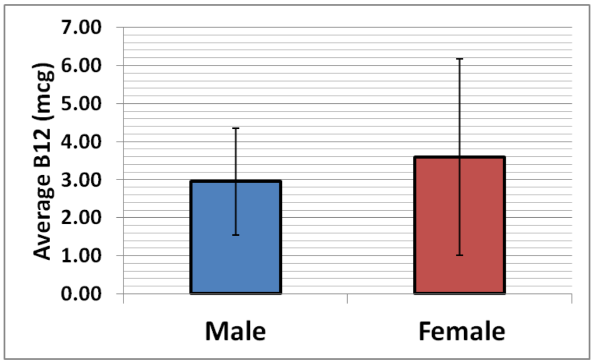

Figure 4. Shows the B12 averages of the males compared to females. It is shown that the male and female averages were both above the RDI of 2.41 mcg, but the male's average was slightly lower. Error bars show both the positive and negative standard deviations of each group.

Another one-tailed t-test assuming unequal variance was also run between athletes and non-athletes to determine significant difference. A value of 0.4936 was returned meaning no significance based on the alpha value of 0.05.

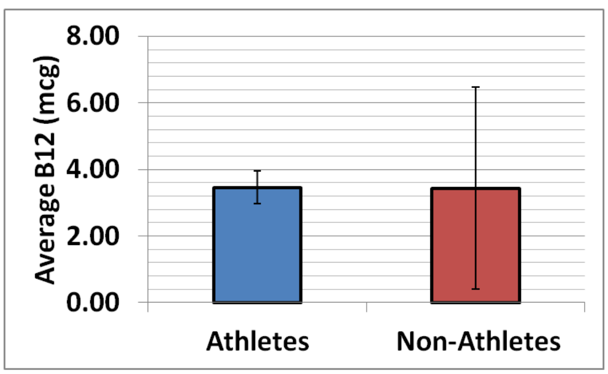

Figure 5. B12 Averages of athletes vs. non-athletes. They were only 0.02 mcg difference and both were above the RDI. Error bars are shown for both the negative and positive standard deviations of each group.

Finally, a one-tailed t-test assuming equal variance was used to determine the significance of animal source B12 totals and other source B12 totals. This test was chose because the totals of both sources were totaled for each participant and so there were two totals for each participant as well as equal variance. A value of 0.3065 from the t-test was returned, meaning there was no significance.

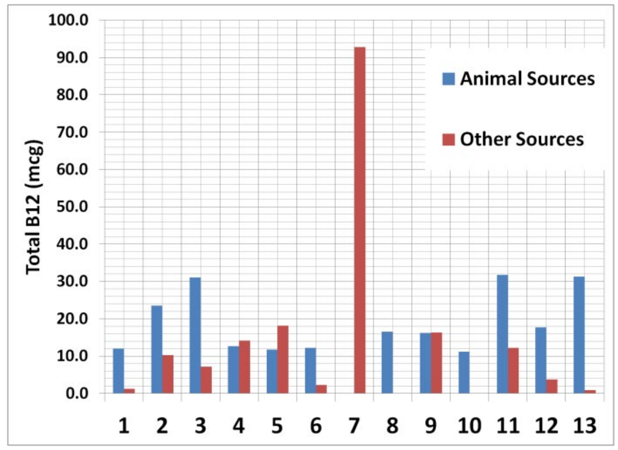

Figure 6. Comparison of animal source totals to other source totals for each subject.

It was noted that there was a major outlier of other sources in number 7 so the test was run again without the outlier in other sources. This value was determined to be an outlier by determining that it was greater than four standard deviations from the mean. Subject 7 (other source outlier) was removed and the t-test value returned was 0.0004, showing a significant difference between the two sources.

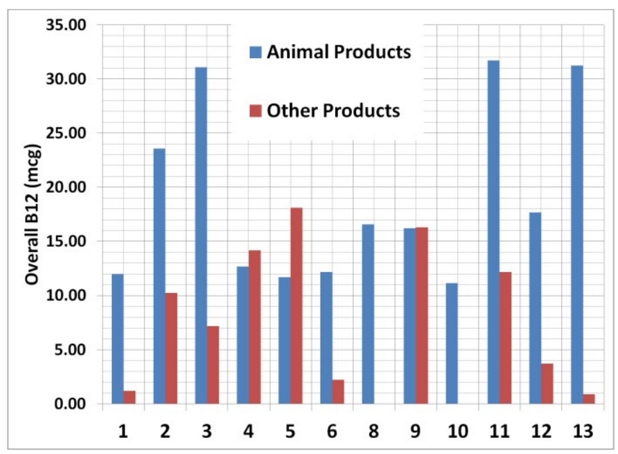

Figure 7. The animal sources vs. other sources excluding the outlier. From this graph it is visible that the other sources are usually lower than animal product sources.

DISCUSSION

By looking at the data and analyzed results, it was clear that most students of McPherson College intake a healthy amount of Vitamin B12. Figure 3 shows the overall averages of the participants and it is clear that most are above the RDI. This is a good thing because this means that the amount of red blood cell formation, nervous system function, and immune system function is not limited by the lack of B12.

The journal averages seemed to vary more at the weekly level and less in the overall averages. It was found that in most participants the intake levels were stilling meeting the RDI of 2.41 for college age students, but there were participants who were regularly low on B12 intake.

For the few that were below the RDI I would recommend either trying to eat more animal sources of B12 such as red meat or milk with added vitamins. Although red meat is a good source the better source for people lacking B12 would be fortified cereals, or supplemented milk replacements such as soymilk or almond milk.

In my results it was evident that the gender of the subject did not make a difference on the amount of B12 taken in. It was observed that males tended to get more B12 from animal sources while females got B12 from other sources such as fortified foods.

When the outliers were removed in the test between animal sources and other sources there was a significant difference shown between the two. This was expected because the majority of sources are animal sources and the other sources of B12 are normally found in supplements. So, unless you are purposefully taking supplements or eating a large amount of fortified foods from the other category you will not be as successful at reaching the RDI of 2.41 mcg.

In this study there were two subjects who did not eat meat. Subject 12 was a vegetarian and subject 7 was a vegan. Subject 12 still got most of her B12 from animal sources such as milk and cheese; Whereas Subject 7 actually had the highest intake levels and this was because she drank at least 16 ounces of soy or almond milk daily. These drinks contain supplemented vitamin B12 and therefore consuming these played a big part in the amount of B12 this participant took in. Subject 12's levels were normally above the average but in the third week the subject had an average intake of 0.73 mcg which actually lowered the overall level to less than 2.41 mcg. I think it would be helpful to educate vegans and vegetarians on the sources of B12 outside of the animal and meat products. This would be beneficial because the lack of B12 can lead to complications of the nervous system and could also decrease the red blood cell production. If the deficiency were to continue the person could develop megaloblastic anemia and begin to suffer from these complications.

In further research it would be helpful to look at specific activity levels of the participants and to correlate the resting heart rates of the subjects to the amount of B12 in the diet of the subject. This would be relevant because of B12's effect on the production of red blood cells. Another possibility would be to take use a blood serum level of B12 and find a correlation from that number to B12 intake levels.

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